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Application of International Academy of Cytology Yokohama System for Reporting Breast Cytology in a Tertiary Care Teaching Hospital

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Abstract

Introduction: The study is based on application of International Academy of Cytology (IAC) Yokohama system of breast cytology.

Aim: The main objectives of this study were to categorize the Breast Fine Needle Aspiration Cytology (FNAC) samples according to this new system of reporting and to assess the Risk of Malignancy (ROM) for each category.

Materials and Methods: A total of 630 FNAC samples from January 2019 to October 2022 were obtained. These were studied and reclassified according to newly proposed IAC Yokohama system of reporting. The ROM was determined. The sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and diagnostic accuracy of Breast FNAC were calculated accordingly.

Results: The breast FNAC samples were distributed as follows: insufficient material 12(1.9%), benign 586 (93. 01%),atypical probably benign 8(1.27%), suspicious for malignancy 12(1.9%) and malignant 12(1.9%). Of the total cases, 274 had histopathological correlation. The respective ROM for each category was 0% for category 1 (insufficient), 1.63% for category 2 (benign), 20% for category 3 (atypical),83.33% for category 4 (suspicious for malignancy) and 100% for category 5 (malignant). The sensitivity, specificity, positive predictive value,

negative predictive value and diagnostic accuracy were 85.71%, 100%, 100%, 99.10% and 99.22% respectively.

Conclusion: Categorization of the Breast FNAC according to IAC Yokohama system of reporting standardizes the management algorithm in patients presenting with breast lumps. It provides a platform for the accurate reporting according to the defined diagnostic criteria and better reproducibility of the reports.

Keywords: Breast cytology, International Academy of Cytology Yokohama system, Risk of malignancy.

Introduction

Breast carcinoma is the most common cancer in females worldwide. It is the most common cause of cancer-related deaths in women in developing countries.

However, in developed nations, it is the second cause of cancer-related deaths subsequent to lung cancer.[1]

Triple assessment is done for the breast lumps which includes clinical examination, imaging studies (ultra sound and/ or mammography) and biopsy (FNAC and core needle biopsy).[2]

FNAC is a simple, relatively painless and inexpensive OPD procedure with speedy results. Accurate diagnosis is not possible in all cases due to significant overlap of the cytomorphologic features of both benign and malignant breast lesions .[3] To address these cytomorphologic grey zone uncertainties and to bring a degree of uniformity in the reporting system, the National Cancer Institute (NCI) proposed five diagnostic categories of breast FNAC cytology in 1996 [4].

In 2016, the International Academy of Cytology (IAC) established a Breast Group to produce standardized guidelines for breast FNAC cytology reporting. The IAC Yokohama System for Reporting Breast Cytopathology incorporates the indications for breast FNAC cytology, FNAC technique, smear making and material handling, a reproducible standardized reporting system, the use of ancillary diagnostic and prognostic tests, and correlation with clinical work-up algorithms. This facilitates clinicians understanding and better workup of the patient [5].

The present study aims to classify the breast lesions on FNAC as per the new reporting system and to calculate the Risk of Malignancy (ROM) and finally correlate the diagnosis with histopathology report wherever possible [6]

Material and methods

The study was conducted in the department of Pathology after the approval by the Institutional Ethical Committee (IEC). It was a retrospective study done from January 2019 to October 2022.A total of 630 female breast FNACs were performed after informed consent. The relevant clinical details were retrieved from the depart mental records. The smears were stained with Giemsa, Pap and H$E. Reclassification of these cases was done as per IAC Yokohama reporting system. Histopathology was considered standard of diagnosis in the study for correlation. All cases which were malignant both on cytology and histopathology were considered True Positive (TP) while True Negative (TN) were cases diagnosed benign on both cytology and histopathology as well. False Positive (FP) were cases given malignant on cytopathology but were found benign on histopathology. Those cases which were given as benign lesion on cytology but were found malignant on histopathology were considered as False Negative (FN) cases.

The cytology and histopathology diagnosis were compared wherever possible and analysis was done to calculate values of ROM, Sensitivity, Specificity,

Positive Predictive Value (PPV), Negative Predictive Value (NPV) and Diagnostic accuracy.

Results

The current study included 630 breast FNAC cases conducted over 4 years' time period. Histopathology samples were available for 274(43.49%) cases and these were considered for correlation.

We had a wide age group range of the cases ranging from 18 years to 63 years with average age being 40.5 years. Maximum cases were from the age group of 21 to 30 years. These cases were reexamined and were classified as per Yokohama reporting system and tabulation of results was done. Maximum cases - 586 (93.01%) were categorized into category 2(Benign). The most common cytological and benign diagnosis in the study was fibrocystic change with 337 cases which was 53.49% of all benign lesions. The malignant cytology cases were 12 (1.90%) (Table. 1 & fig. 1). The youngest age at which malignancy was diagnosed by cytology was 28 years while the oldest case was 63 years old.

Histopathology correlation was available for 245 (41. 80%) cases out of 586(93.01%) cases categorized as benign on cytology. Out of these, 2 cases were found malignant on histopathology.

In the cytological malignant category cases, histopathology was available for 12 (100%) cases and all were in concordance with the cytological diagnosis. 1 out of 8 cases of atypical probably benign category and 10 out of 12 suspicious category cases turned out to be malignant on histopathology. (Table. 2. & fig.2) This could be attributed to more amount of tissue being available for examination in histopathology.

The most common benign histopathological diagnosis was fibroadenoma while Invasive Carcinoma NST was the most common malignant diagnosis. (Table.3.)

Discussion

Women present with a large number of benign lesions in addition to malignant lesions in the breast [7]. In the course of time, the traditionally used triple assessment approach (including FNAC, clinical examination, and mammography) has evolved into a broader approach including ultrasound (in case of young females) and the replacement of FNAC with Core Needle Biopsy (CNB) [8]. In order to establish the importance of FNAC as an economically viable diagnostic tool, the present study was conducted to analyze ROM in FNAC breast cases which were categorized according to the new IAC Yokohama System. In our study, we found that FNAC was highly sensitive and specific for malignant lesions. The new IAC Yokohama System provides an improved structured format for reporting breast lesions by giving comprehensive definitions and descriptions as well as ROM for the standardized five categories. It helps in breaking the communication barrier between the pathologists and the clinical management team as it also gives management recommendations according to the respective ROM for each category.[9]

In our study, we retrieved a total of 630 cases from year 2019 to 2022. The maximum and minimum number of cases were retrieved in the years 2021 and 2020, respectively. Classification of all cases was done according to the newly proposed IAC Yokohama system. We had 1.90% insufficient cases, 93.01% benign, 1.27% atypical; most likely benign lesions, 1. 90% suspicious for malignant lesion and 1.90% malignant cytological cases, while same type of study con ducted by Montezuma et al in 2019 gave values of 5.7 7% insufficient, 73.38% benign, 13.74% atypical, 1.57% suspicious and 5.54% malignant cases [10].

Another study performed by Stephen Wong demonstrated values of 11%, 72%, 4.3%, 2.2%, and 10% for insufficient, benign, atypical, suspicious and malignant category, respectively [11]. Similarly, a study conducted by Hoda et al revealed values of cytological cases from 26 studies as 6.8%, 39.6%, 7.3%, 7.5% and 38.9% in the five tier IAC Yokohama system, respectively [12]. An Indian study also yielded values of 1.3% C1 cases, 82.6% C2 cases, 5.7% C3 cases, 1.7% C4 cases and 8.4% C5 cases.[13] Based on our study, as well as the studies mentioned above, the maximum number of cases were classified into benign category.

In the present study, histopathology diagnosis was available in 274cases and these were used for statistical analysis. Category 1(C1) - Insufficient are those cytology smears that are either too sparsely cellular or too poorly smeared or fixed to allow a cytological diagnosis. We had 12 cases in this category. The ROM calculated for this category was 0%. This was lower than the studies conducted by Appuroopa M et al. (5%) [14], Nargund A et al. (7.69%) [15], Wong S et al (2.6%) [16] and Montezuma D et al. (4.8%) [10]. A proper aspiration technique, Rapid On-Site Evaluation (ROSE) of smears and availability of radiological investigations will allow better interpretation in such cases.

Category 2 (C2) – includes cases with well-defined benign cytological features, which may or may not be diagnostic of a specific benign lesion and include inflammatory lesions, cysts, benign neoplasms and epithelial hyperplasia. The calculated ROM of this category was 1.63% which was less than the study of Tejeswini V et al. (5.32%) [16] Nargund A et al. (15. 26%) [15], Kamatar PV et al. (4%) [17], Hoda RS et al. (4.7%) [12] but higher than studies of Appuroopa M et al. (1.2%) [14] Montezuma D et al. (1.4%) [10] Wong S et al. (1.7%) [11].

Category 3 (C3) - Atypical breast cytology is defined as presence of cytological features seen predominantly in benign lesions but with the presence of some features of malignancy[6].The ROM calculated for this category was 20%.This was higher than studies of Montezuma D et al. (13-15.7%) [10],Wong S et al. (15.7%) [11], Tejeswini V et al. (26.31%) [16], Appuroopa M et al. (12.5%) [14] but lower than Kamatar PV et al. (66%) [17] and Nargund A et al (65.38%) [15]. We had 8 cases diagnosed as atypical on cytology. Out of these, 5 cases were available for histopathological correlation.4 cases showed discordance on HPE. This could be due to difficulty in recognizing and correctly assessing the low grade atypia on cytology smears, which greatly depends on the experience of the pathologist.

Category 4(C4) - Suspicious of malignancy terminology is used when there are some cytological features of malignancy but with insufficient malignant features either in number or quality to make a definite diagnosis of malignancy [6]. The ROM here was 83.33%. This was similar to the studies of Wong S et al. (84.6%) [11], Kamatar PV et al. (83%) [17], Nargund A et al. (83.3%) [15], but slightly lower than studies of Wai CJ et al. (97.1%) [8] and Tejeswini V et al. (100%) [16].2 cases out of total 12 showed discordance on HPE in this category. Misdiagnosis of suspicious lesions as benign resulted from scant cellularity associated with deep seated lesions and low-grade cytological atypia. Another reason could be the needle missing the mass lesion in breast.

Category 5(C5) - Malignant cytological diagnosis is given when there are definite cytological features of malignancy. All 12 cases of this category whose

histopathology was also available were diagnosed as malignant. The ROM of 100% was similar to Montezuma D et al. (100%) [10], Wai CJ et al. (100%) [8], Wong S et al. (99.5%) [11], Nargund A et al. (99. 18%) [15], Appuroopa M et al. (100%) [14], Tejeswini V et al. (100%) [16].

Sensitivity, Specificity, Positive Predictive Value and Negative Predictive Value in the current study were calculated as 85.71%, 100%, 100% and 99.10% respecti vely. These were close to the values obtained by Montezuma D et al. [10] and Kamatar PV et al [17].

Diagnostic accuracy of FNAC in our study was 99.22% which was similar to the results of Kamatar PV et al. (96.97%) [17], Cunha MD et al. (96.55%) [18] and Chauhan V et al. (99.1%) [19]. The study by McHugh KE et al. [18] done on 695 breast FNAC cases had a diag nostic accuracy of 89%. Another study conducted by De Rosa F.et al which included 4624 USG guided FNACs had diagnostic accuracy of 92.82% [20]. **(**Table.4.)

Conclusion

FNAC of female breast lesions is a rapid, relatively painless and cost effective OPD diagnostic technique. It has less complications and can diagnose a wide spectrum of diseases with high accuracy and less turnaround time than histopathological examination.

The recent standardized IAC Yokohama breast cytology reporting system provides primary categorization of palpable breast masses into in five distinctly defined diagnostic categories with implied ROM.

This system also provides enhanced communication between pathologists and attending clinicians for the benefit of the patient and helps in better patient management.

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Legend Tables and figures

Table 1: Categorization of Breast Cytology cases according to IAC Yokohama Reporting System

Sn.	Category	2019	2020	2021	2022	Total
1.	Insufficient	02	03	05	02	12(1.90)
2.	Benign	143	77	189	177	586(93.01)
3.	Atypical	02	01	03	02	8(1.27)
4.	Suspicious	03	02	04	03	12(1.90)
5.	Malignant	04	02	02	04	12(1.90)
6.	Total	154	85	203	188	630(100)

Table 2: Cytological and Histopathological correlation of each Yokohama category with calculation of Risk of Malignancy

Sn.	Category	Total cytology cases	Histopathology Benign	Histopathology malignant	Total Histopathology	ROM
1.	Insufficient	12(1.90)	-	-	-	0%
2.	Benign	586(93.01)	243	2	245	1.63 %
3.	Atypical	8(1.27)	4	1	5	20%
4.	Suspicious	12(1.90)	2	10	12	83.33 %
5.	Malignant	12(1.90)	-	12	12	100 %
6.	Total	630(100)	249	25	274	

Table 3: Statistical analysis in current study

True Positive (TP)	12
False Positive (FP)	Nil
True Negative (TN)	243
False Negative (FN)	2
Sensitivity	85.71%
Specificity	100%
Positive Predictive Value (PPV)	100%
Negative Predictive Value (NPV)	99.18%
Diagnostic accuracy	99.22%

Table 4: Results of various studies compared with the present study are as follows

	Current study	Montezuma D et al.	Cunha MD et al.	Appuroopa M et al.	Kamatar PV et al.
Sensitivity (%)	85.71	97.56	94.4	95.9	94.59
Specificity (%)	100	100	100	97.89	98.9
Positive Predictive Value (%)	100	100	100	96.79	98.59
Negative Predictive Value (%)	99.10	98.62	91.66	97.64	95.74
Diagnostic Accuracy (%)	99.22	99.11	96.55	98.57	96.97

Fig 1: Percentage of cases in each category (year wise) according to the IAC Yokohama reporting system

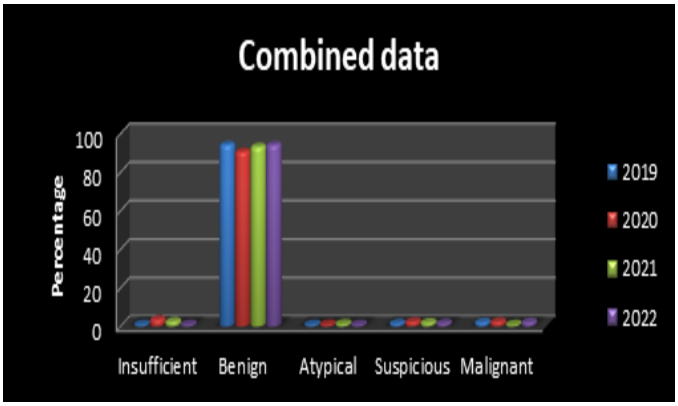

Figure 2: Cyto – histopathological correlation of cases in each Yokohama diagnostic category.

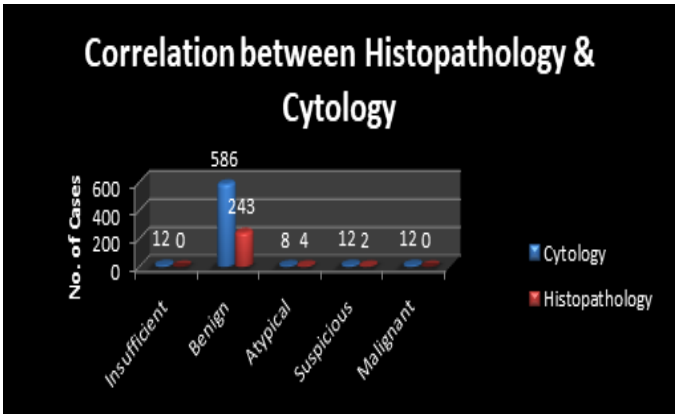

Fig 3: ROC curve of cytology cases